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# THE Journal of the Society of Arts, AND OF THE INSTITUTIONS IN UNION.

110TH SESSION.]

FRIDAY, JULY 8, 1864.

[No. 607. VOL. XII.]

## Announcements by the Council.

### COUNCIL MEETING.

Wednesday, 6th July, 1864.

At the first Meeting of the present Council since their election, William Hawes, Esq., Vice-President, was unanimously re-elected Chairman for the current year.

## Proceedings of the Society.

### CANTOR LECTURES.

"ON CHEMISTRY APPLIED TO THE ARTS." BY DR. F. CRACE CALVERT, F.R.S., F.C.S.

#### LECTURE I.

DELIVERED ON THURSDAY EVENING, MARCH 31st, 1864.

**BONES.**—Composition of raw and boiled bones. The manufacture of superphosphate of lime. Application to agriculture. Bone-black or char, and its use in sugar refining. *Phosphorus*, its properties, extraction and employment in manufacture of matches. *Horn* and *ivory*, their composition and applications.

I shall not take up your time by making many preliminary remarks, but merely state that though the heads of the subject on which I intend to speak are not inviting ones, still we shall find as we progress that the study of the various matters which I shall bring before you is full of interest and instruction. Further, it would be difficult to name subjects which better illustrate the ability of man to turn to profitable account the various materials placed in his hands, or to mention substances which have received more complete and skilful applications than those we shall treat of this evening.

**BONES.**—The composition of "green bones," or bones in their natural state, may be considered under two general heads, viz.:—the animal matters, consisting of a substance called *osséine* and a few blood-vessels, and the mineral matters, chiefly represented by phosphate of lime and a few other mineral salts. The composition of bones has been examined by many eminent chemists, but the most complete researches are those published in 1855 by Mr. Fremy, who examined bones, not only from various classes of vertebrated animals, but also from different parts of the same animal; and to enable you to appreciate some of his conclusions, allow me to draw your attention to the table in the next column.\*

The first conclusion drawn by Mr. Fremy from these researches, is that he found a larger proportion of mineral matter than is generally admitted by chemists. Secondly, that there is no material difference in the composition of various bones taken from different parts of man, or of any one animal, but that age has a very marked influence on composition. Thus, in the bones of infants there is more animal and less mineral matter than in the adult, whilst in old age there is more mineral and less animal matter

### COMPOSITION OF BONES.

Name of Bone.	Mineral matter.	Phosphate of Lime.	Phosphate of Magnesia.	Carbonate of Lime.
Femur — Fœtus 6 months	63.0	58.9		5.8
" Boy 18 "	61.6	58.0	0.5	2.5
" Woman 22 years	60.1	59.4	1.3	7.7
" Man 30 "	63.2	57.7	1.2	9.3
" 40 "	64.2	56.3	1.3	10.2
" Woman 80 "	64.6	57.1	1.2	7.5
" 97 "	60.8	51.9	1.3	9.3
" Lion (young) .....	64.7	60.0	1.5	6.3
" Sheep .....	70.0	62.9	1.5	7.7
Sperm Whale .....	62.9	51.9	0.5	10.6
Ostrich .....	70.0			
Carapace of Turtle .....	64.3	58.0	1.2	
Codfish .....	61.3			
Stag's horn .....	61.9	58.1	traces	3.8
Cow's tooth Bone .....	67.1	60.7	1.2	2.9
" Enamel .....	96.9	90.5	traces	2.2
" Ivory .....	74.8	70.3	1.3	2.2
Scales of the Carp .....	34.2	33.7	traces	1.1

than in the middle-aged man. The mineral substance which chiefly increases in old age is carbonate of lime. Lastly, he could find no marked difference between the bones of man, the ox, calf, elephant, and whale; whilst in the bones of carnivorous animals and those of birds there is a slight increase in the amount of mineral matter. Allow me now to call your attention to a most interesting query. I hold in one hand the mineral matter only of a bone, which you can see retains perfectly its original form, and in the other hand I have the animal matter only of a similar bone, which also retains the form in which it previously existed, but is flexible instead of rigid. The question, therefore, arises, whether the strength and hardness of bones proceed from these two kinds of matter being combined together, or are their respective molecules merely juxtaposed? The answer is, the latter; for, as you see by this specimen, the mineral matter has been entirely removed without deforming the animal texture. Further, in the fœtus it is found that the bones contain nearly the same proportions of animal and mineral matters as those of the adult. Also, it has been observed by Mr. Flourence and other eminent physiologists, that the wear and tear of bones during life is repaired by the formation of new bone on the exterior surface of the bone, while the old substance is removed through the interior duct, and that the composition of the new layer is the same as that of the original bone. Let us now proceed to examine the chemical properties of the various substances composing bones, and some of the various applications which they receive in arts and manufactures. The general composition of bones may be considered to be as follows:—

#### BONES.

Organic Substances.	Blood-vessels .....	1
	Osséine .....	32
	Fatty Matters .....	9
	Water .....	8
Mineral Substances.	Phosphate of Lime .....	38
	Phosphate of Magnesia .....	2
	Carbonate of Lime .....	8
	Divers Salts .....	2

The above-named animal matter, *ossein*, C 50.4, H 6.5, N 16.9, O 26.2, and which has been erroneously called gelatine, is insoluble in water, weak acids, and alkalis, whilst gelatine presents properties directly the reverse. But what has led to this popular error is that *ossein*, when boiled in water, becomes converted into the isomeric substance commonly called gelatine. As I shall have to dwell on this substance at some length in my next two lectures, I will not detain you now further than to state that *ossein* is obtained from bones by placing them in weak hydrochloric acid, which dissolves the phosphate of lime and other mineral salts, washing the animal substance *ossein* until all acid is removed, drying it, and treating it with ether to remove fatty matters. I cannot leave this subject without remarking on the extraordinary stability of this animal substance, for it has been found in the bones of man and animals after many centuries, and even in small quantities in fossil bones.

The fatty matter of bones is made useful in the manufacture of soap, railway grease, and for other purposes; it is obtained by taking fresh bones (as bones which have been kept a long time will not yield their grease easily) and placing the spongy parts, or ends of the bones, (where most of the fatty matter exists) in large boilers filled with water, which is then carried to the boil, when a part of the *ossein* is converted into gelatine and the fatty matter liberated rises to the surface, and is easily removed. The bones thus treated are called boiled bones, and receive many important applications, to which your attention will be called in a few minutes. Benzine and bisulphuret of carbon have been used as substitutes for water in the above operation, but the advantages do not seem to have been sufficient to lead to their general adoption.

*Mineral Matter of Bones.*—These, as the foregoing tables show, are chiefly represented by phosphate and carbonate of lime. The immortal Berzelius was the first to establish the fact that phosphate of lime was the only substance possessing the properties necessary for the formation of bone, owing to the extremely simple chemical reactions which cause the soluble phosphates to become insoluble. Let us trace shortly the sources from whence we derive the large proportion of phosphate of lime which exists in our frames. Several of our most eminent chemists have proved the existence of phosphorus in sedimentary and igneous rocks, and the important part played by phosphorus in nature cannot be better conveyed to your minds than by this extract from Dr. Hofmann's learned and valuable Report on the Chemical Products in the Exhibition of 1862—"Large masses of phosphorus are, in the course of geological revolutions, extending over vast periods of time, restored from the organic reigns of nature to the mineral kingdom by the slow process of fossilization; whereby vegetal tissues are gradually transformed into peat, lignite, and coal; and animal tissues are petrified into coprolites, which, in course of time, yield crystalline apatite. After lying locked up and motionless in these forms for indefinite periods, phosphorus, by further geological movements, becomes again exposed to the action of its natural solvents, water and carbonic acid, and is thus restored to active service in the organisms of plants and lower animals, through which it passes, to complete the mighty cycle of its movements into the blood and tissues of the human frame. While circulating thus, age after age, through the three kingdoms of nature, phosphorus is never for a moment free. It is throughout retained in combination with oxygen, and with the earthy or alkaline metals, for which its attraction is intense." After these eminently philosophical views by Dr. Hofmann, I will proceed to call your attention to the application of bones to agriculture. Bones are generally used for manuring in one of these three forms:—1st. As ground green bones; 2nd. As ground boiled bones (that is, bones nearly deprived of their *ossein* by boiling under pressure, as I shall describe in my next lecture); 3rd. Superphosphate of lime.

Green or raw bones have been used on grass land for

a long period, but their action is exceedingly slow and progressive, owing to the resistance of the organic matter to decomposition and the consequently slow solubility of the phosphate of lime in carbonic acid dissolved in water. What substantiates this view is that boiled bones are far more active than the above. It is found that from 30 to 35 cwt. per acre of these will increase the crops on pasture land from 10 to 20 per cent. in the second year of their application. But the great advantage which agriculture has derived from the application of bones as a manure, has arisen from their transformation into superphosphate of lime, especially applicable to root and cereal crops. To Baron Liebig is due the honour of having first called the attention of farmers (in 1840) to the importance of transforming the insoluble phosphate of lime of bones into the soluble superphosphate, rendering it susceptible of immediate absorption by the roots of plants, and of becoming at once available for their growth. These suggestions of Liebig were rapidly carried out on a practical scale by Messrs. Muspratt, of Lancashire, and J. B. Lawes, of Middlesex; in consequence of the valuable results obtained by them, the manufacture of artificial manures has gradually grown into an important branch of manufacture in this country. The manufacture of superphosphate of lime is so simple that any farmer possessing a knowledge of the mere rudiments of chemistry can make it for himself, by which he will not only effect great economy, but also secure genuineness of product. All he requires is a wooden vessel lined with lead, into which can be placed 1,000 lbs. of ground boiled bones, 1,000 lbs. of water, and 500 lbs. of sulphuric acid sp. gr. 1.845 (or concentrated vitrol), mixing the whole, and stirring well for about twelve hours. After two or three days a dry mass remains, which only requires to be taken out and placed on the land by means of the drill, or to be mixed with water and sprinkled on the land. When very large quantities of this manure are required, the plan devised by Mr. Lawes appears to me to be the best. It consists in introducing into the upper end of a slightly-inclined revolving cylinder a quantity of finely-ground boiled bones, together with a known proportion of sulphuric acid of sp. gr. 1.68. As the materials slowly descend by the revolution of the cylinder they become thoroughly mixed, and leave it in the form of a thick pasty mass, which is conducted into a large cistern capable of containing 100 tons, or a day's work. This is allowed to remain for twelve hours, when it is removed, and is ready for use. Most manufacturers find it necessary to add to the phosphate of lime of bones other sources of phosphates, such as coprolites, or the fossil dung of antediluvian animals which have been found in large quantities in Suffolk, Cambridgeshire, and elsewhere, and contain from 36 to 62 per cent. of phosphate of lime, and from 7 to 38 per cent. of organic matter. Others employ a mineral substance called apatite containing about 92 per cent. of phosphate of lime, and found also in large quantities in Spain, Norway, France, &c. Others, again, employ guanos rich in phosphate of lime, such as those of Kooria Moorla Islands and Sombrero phosphates. The following is the average composition of the superphosphate of lime of commerce:—

Soluble Phosphate .....	22	to	25	per cent.
Insoluble " .....	8	"	10	"
Water .....	10	"	12	"
Sulphate of Lime .....	35	"	45	"
Organic Matter .....	12	"	15	"
Nitrogen 0.75 to 1.5 per cent.				

The valuable and extensive researches of Messrs. Lawes and Gilbert, and Messrs. Bousingault and Ville, have not only demonstrated the importance of phosphates to the growth of cereal and root crops, but also that phosphates determine in a great measure during vegetation the absorption of nitrogen from the nitrates or from ammonia, as will be seen by the following table:—

AMOUNT OF NITROGEN FIXED BY WHEAT UNDER THE  
INFLUENCE OF THE FOLLOWING SALTS:—

	Without Nitrogenated compounds.	With Nitrogenated compounds.
Phosphate of Lime and } ...	8.15	20.08
Alkaline Silicate }		
Phosphate of Lime .....	7.25	19.17
Earths and Alkaline Silicates	5.71	11.16
Earth .....	3.00	9.50

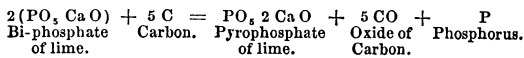
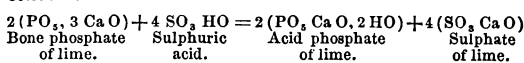
*Bone-black or Char.*—In 1800, Löwitz made the interesting observation that wood charcoal possesses the remarkable property of removing colouring matters from their solutions. In 1811, Figuier also observed that animal black has far greater decolorating power than wood charcoal, and bone-black has consequently become one of the principal agents in sugar-refining, and has been the means, more than any other substance, of producing good and cheap white sugars. To give you an idea of the extent to which bone-black is used at the present day for decolorating purposes in the refining of sugar, I may state that in Paris alone it is estimated that about 11 million kilogrammes of bones are used annually for that purpose. The preparation of bone black is simple in principle. It consists in placing in cast iron pots about 50lbs. of broken boiled bones, that is, bones which have been deprived of their fat—of most of their osseine, and piling these pots in a furnace, where they are submitted to a gradually rising temperature, during 24 hours, such as will completely decompose the organic matter, but not so high as to partly fuse the bones and thus render them unfit for their applications. But a more economical process is generally adopted. It consists in introducing the crushed bones into horizontal retorts, which are themselves in connection with condensers, the ends of which are brought under the retorts to assist by their combustion in the distillation of the animal matter. By this arrangement not only is char obtained, but oily matters which are used by curriers, and also ammoniacal salts employed in agriculture and manufactures. The extraordinary decolorating action of animal blacks may be considered as partly chemical and partly mechanical—mechanical because it is proved, by some interesting researches of Dr. Stenhouse, to which I shall refer further on, that the action is due to the minute division of the carbon and the immense surface offered by its particles to the coloring matter, char being composed of 90 parts of mineral salts to 10 per cent. of carbon. On the other hand, the action is proved also to be chemical, by the fact that water will not remove the coloring matter, whilst a weak solution of alkali will dissolve it. Dr. Stenhouse's valuable researches not only illustrate fully this fact, but also prove the possibility of producing artificially substitutes for bone-black. In 1857 he published a paper describing the production of an artificial black, called by him aluminized charcoal. This he obtained by mixing intimately, and heating, finely pulverized charcoal and sulphate of alumina, when he obtained a powerful decolorating agent containing 7 per cent. of alumina, and well adapted for decolorating acid solutions, such as those of tartaric and citric acids, in chemical works. He also prepared what he called coal-tar charcoal, by melting one pound of pitch in a cast-iron pot, adding to it two pounds of coal-tar, and mixing intimately with it seven pounds of hydrate of lime, then carrying the whole to a high temperature, allowing it to cool, removing the lime by washing the mass with hydrochloric acid, and then with water, when carbon in a high state of division was obtained, possessing powerful decolorating properties. The following series of experiments by Dr. Stenhouse perfectly illustrate the chemico-physical action of animal black as a decolorating agent. He boiled a certain amount of char and his two charcoals, with a solution of logwood, then treated each black separately with ammonia, when the following results were obtained: Aluminized charcoal yielded no colour. Bone-black but a slight amount. Coal-tar charcoal, large quantities. But it would be

wrong in me to leave you under the impression that animal black can only remove colours from solutions. Purified animal black, that is to say, animal black deprived of its mineral matters by the action of muriatic acid and subsequent washing, has the power of removing certain bitters from their solutions. Thus Dr. Hofmann and Professor Redwood applied this property with great skill, some years ago, to the detection of strychnine in beer. Again, Mr. Thos. Graham, Master of the Mint, published a most interesting series of researches, in which he established the fact that purified animal black had the power to remove a great number of saline matters from their solutions, such as the salts of lime, lead, copper, &c.

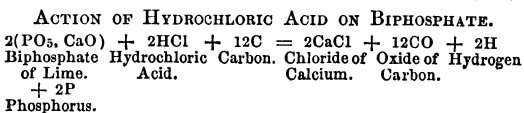
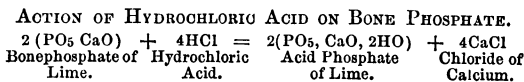
*Revivification of Bone Black.*—After a certain quantity of syrup sugar has percolated through the cylinders containing bone black, the interstices become so clogged with impurities that it loses its power of decolorating the syrup. Sugar refiners are therefore in the habit of restoring the power of their bone black, generally speaking, by submitting it to a process of calcination, which volatilizes or destroys the organic matter fixed by the char. It has been proved by experience that char may undergo this operation about 20 times before its pores become so clogged with dirt as to render it useless. [Here the lecturer described, with the aid of drawings, several of the various apparatus used in sugar refineries for the above process, alluding particularly to that of Messrs. Pontifex and Wood, by which a ton of char is revived every 24 hours.] A new process, however, has been devised by Messrs. Leplay et Cuisinier, which as a whole deserves the attention of refiners, though I am aware that several of the details of their process have been used for some time. The char which has served its purpose in the cylinders, instead of being removed, is treated at once by the following processes. It is first thoroughly washed, treated by steam to remove all viscous substances, then a weak solution of alkali is allowed to percolate through the char, which removes saline matters and a certain amount of colouring matter, when it is further acted upon by weak hydrochloric acid, which in removing a certain amount of the lime salts liberates the colouring matters, the char is again washed with weak alkali to remove the remaining colouring matter, and lastly the decolorating power of the black is restored by passing through it a solution of biphosphate of lime. It is to be hoped that the high praise bestowed upon this process on the Continent may induce our manufacturers to try it, as they would obtain two distinct advantages by its use:—First, the economy of operating at once upon the black and restoring its properties without removing it from the cylinders: Secondly, the prevention of the noxious odours given off during the revivification of char by the ordinary methods. It is interesting to note one of the results of the different employment of char in this country and on the continent. In England the wear and tear in sugar refinery is constantly repaired by the introduction of fresh char, and there is no spent or old char for sale. In France, on the contrary, owing to the great impurities in their beet-root sugar syrups, and to the use of blood in refinery, the char becomes rapidly clogged with organic matter, and is so completely animalized, that its value as a manure exceeds what the char originally cost the refiner. The result is that French "spent" char is annually exported to the French colonies to the amount of 120,000 tons, and is there used as a manure to promote the growth of the sugar cane. So important is this article of commerce considered, that the French government have appointed special analytical chemists to determine its value for the trade.

*Phosphorus.*—I am now about to call your attention to one of the most marvellous and valuable substances ever discovered by chemists. In 1660, Brandt, a merchant of Hamburgh, discovered a process for obtaining phosphorus from putrid urine, but though he kept his secret, a chemist named Künckel published the mode of obtaining it from this fluid. A hundred years later, Gahn discovered the presence of phosphorus in bones; and Scheele

shortly afterwards gave a process to obtain it therefrom. The process devised by this eminent chemist was shortly afterwards improved upon by Nicolas and Pelletier, and their method was so completely worked out by Fourcroy and Vauquelin, that it is still the process used in the present day. The preparation of phosphorus consists of 4 distinct operations:—1st, 80 parts of thoroughly calcined and pulverised bones are mixed with 80 parts of sulphuric acid, sp. gr. 1.52, to which is then added 400 parts of boiling water; 2ndly, after a few days the clear liquor, containing bi-phosphate of lime, is removed from the insoluble sulphate, and evaporated until it has the specific gravity of 1.5; 3rdly, this liquor is mixed with 20 per cent. of finely-pulverised charcoal, and the whole is dried at a moderately high heat, when, 4thly, it is introduced into an earthenware retort, placed in the galley furnace, and on heat being slowly applied phosphorus distils, and the operation is continued at a high heat for two or three days. It is, however, necessary that the phosphorus thus obtained should be purified, and this is effected by melting the phosphorus under water, and pressing it through a chamois skin. It is then boiled with caustic alkali to remove other impurities, but what is still better is to heat the phosphorus with a mixture of bichromate of potash and sulphuric acid. The phosphorus thus purified is drawn through slightly conical glass tubes by the suction of a caoutchouc pouch, or is allowed to run by an ingenious contrivance into tin boxes. As will be seen by the following formula, the manufacturer only obtained from the bones one-half of the phosphorus they contain:—



Consequently many attempts have been made to devise a chemical-reaction by which the whole of the phosphorus might be secured. The most successful attempt of late years is that made by Mr. Cary-Montrand, whose process is based on the following chemical reaction:—



He arrives at this result by treating calcined bones with hydrochloric acid; the liquor is then mixed with charcoal, and the whole dried at a moderate heat. The prepared mass is then introduced into cylinders through which a stream of hydrochloric acid is made to percolate, and, as shown above, chloride of calcium, hydrogen, carbonic oxide, and two proportions of phosphorus are produced. (The process of Fleck was also described.) Phosphorus prepared and purified by the above processes is a solid, semi-transparent body, having a sp. gr. 1.83, fusing at 110.5° F., and boiling at 550°. It is so inflammable that it ignites in the open air at several degrees below its fusing point; but Professor Graham made, some years ago, the interesting observation that this slow combustion of phosphorus could be entirely checked by the presence of certain combustible vapours. Thus he found that one volume of vapour of naphtha in 1,820 of air, or one volume of vapour of oil of turpentine in 4,444 of air, completely prevented the spontaneous combustion of phosphorus. Further, phosphorus presents the curious property, that, if heated to 160°F. and suddenly cooled, it becomes black, and if heated to 450° or 460° for several hours, it becomes amorphous, and of a dark brown colour. This allotropic state of phosphorus, first noticed by Schrotter, has enabled it to render great service to society,

owing to its not being spontaneously inflammable (as in fact it only becomes so at a temperature approaching its point of fusion), and also to its not being poisonous, so that it can be substituted for common phosphorus in the manufacture of matches with great advantage. Lastly, owing to this brown amorphous phosphorus not emitting any vapours, those employed in the manufacture of chemical matches now avoid the risk of the dreadful disease of the jaw-bone, called phospho-necrosis. Notwithstanding the great difficulties attending the manufacture of this valuable product, Mr. Albright, of Birmingham, has, with praiseworthy perseverance and great skill, succeeded in obtaining it perfectly pure on a large scale, and at such a price as to bring it within the scope of commercial transactions.

*Chemical Matches.*—Although I do not intend to enter at great length upon this subject, yet as it is a highly important one, I deem it my duty to lay a few facts before you. The first application of chemistry to the discovery of a substitute for the old tinder-box of our fathers, was made in 1820, when the sulphuretted ends of matches were covered with a mixture of chlorate of potash, lycopodium, and red lead, and the matches so prepared were dipped into asbestos moistened with sulphuric acid. In 1836, lucifer matches were first introduced, and the explosive matches were soon followed by the non-explosive ones. The composition of these matches is as follows:—

	Non-Explosive.	Explosive.
Phosphorus .....	25 or 30	9 or 4
Red lead .....	5 „ 20	16 „ 3
Nitre .....	0 „ 0	14 „ 10
Sand .....	20 „ 20	
Vermillion .....	1 „ 0	
Gum or glue .....	20 „ 25	16 „ 6

The danger as well as the disease attendant on this manufacture was greatly mitigated by Professor Graham's discovery of the property of turpentine vapour already alluded to. Until lately the only successful application of amorphous phosphorus to lucifer matches was that of Messrs. Coignet, Frères, of Paris, who caused a rough surface to be covered with it, and so prepared their matches that they would not ignite except when rubbed upon the prepared surface. Similar matches, under the name of "special safety matches," have also been introduced into this country of late by Messrs. R. Letchford and Co., who have also effected several important improvements in this branch of manufacture, in one of which paraffin is made use of to carry combustion to the wood, instead of sulphur, which gives rise to the noxious fumes of sulphurous acid, and as the substitution is made by Messrs. Letchford without any increase of cost, the price of these matches is as low as that of the common ones. These gentlemen have also found the means of diminishing the amount of phosphorus used to a very considerable extent, so that the disagreeable smell of this substance is also avoided. But the greatest improvement that Messrs. Letchford have made is in what they call their hygienic matches, or lights, in which for the first time amorphous phosphorus is substituted for ordinary phosphorus, and in small quantities. The advantage of these matches cannot be overrated, for children can eat them with impunity, as amorphous phosphorus is not poisonous; they are not nearly so combustible, and therefore not so likely to cause accidental fires; and lastly, all source of injury to the health of those employed in the manufacture is removed. I cannot leave this subject without still drawing your attention to one or two important facts. Messrs. Hochstetter and Canouil, besides others, have lately introduced chemical matches free from phosphorus, which are stated to have the following composition:—

Chlorate of Potash .....	10	10	10
Hypsulphite of Lead .....	26	26	20
Peroxide of Lead .....	...	9.8	...
Peroxide of Manganese .....	...	...	33.6
Chromate of Lead .....	17	4	8.8
Gum Arabic .....	4	4	4

An important improvement in the manufacture of chemical matches is the reduction of the proportion of phosphorus to a minimum. This is effected by reducing the phosphorus to an infinitesimally minute division, by which the manufacture is rendered more economical, and the matches, when ignited, have less of the unpleasant odour of phosphorus. This division is accomplished by using a solution of phosphorus in bisulphuret of carbon, by which a saving of 19-20ths of the phosphorus is obtained. Another invention is that of Messrs. Puscher and Reinsch, who have proposed the employment of sulphide of phosphorus.

*Ivory.*—The lecturer, having given some details respecting the properties of ivory, said—I will now call your attention to the substitution of the following mixture for ivory tablets as applied in photography. Finely-pulverized sulphate of baryta is mixed with gelatine or albumen, compressed into sheets, dried, and polished; these sheets are ready for use in the same way as ivory plates. You are all doubtless aware that the nut of the *Phytolaphas macrocarpa*, of the palm tree tribe, has for many years been used in this country as a substitute for ivory, and it may be interesting to you to be made acquainted with the two following facts, viz., that the nut is composed of—

Pure cellulose .....	81 per cent.
Gum .....	6    "
Nitrogenated principles ...	4    "
Water .....	9    "

Total ..... 100

and Dr. Phipson has recently published a method of distinguishing this vegetable ivory from the animal one by means of sulphuric acid, which gives a beautiful purple colour with the vegetable ivory but none with the animal ivory.

*Horn.*—Horns of the best quality, and especially the beautiful ones obtained from the buffaloes in India and America, receive a great variety of applications at the present day, owing to their great toughness and elasticity, as well as to their remarkable property of softening under heat, of welding, and of being moulded into various forms under pressure. To apply horns to manufactures they are treated as follows:—They are first thrown into water, and slight putrefaction commences, by which ammonia is produced, when the horn begins to soften. To carry this action further the horns are transferred into a slightly acid bath, composed of nitric and acetic acids, with a small quantity of various salts. When the horns are sufficiently softened, which requires about two weeks, they are cleaned and split into two parts by means of a circular saw, and these are introduced between heated plates, and the whole subjected to an intense pressure of several tons to the square inch. The plates may be moulds, and thus the horn may be compressed into any required shape. A great improvement has recently been effected in this branch of manufacture, which consists in dyeing the horn various colours. To accomplish this the horn is first dipped into a bath, containing a weak solution of salts of lead or mercury, and when the horns have been thus impregnated with metallic salts, a solution of hydro-sulphate of ammonia is rubbed upon them, when a black or brown dye is produced. Another method consists in mordanting the horn with a salt of iron, and dipping it in a solution of logwood. Of late, very beautiful white fancy articles have been produced from horn by dipping it first into a salt of lead, and then into hydrochloric acid, when white chloride of lead is fixed in the interstices of the horn, which then simply requires polishing.

This lecture, as well as those which followed, were illustrated by numerous specimens and experiments.

### Proceedings of Institutions.

**FAVERSHAM INSTITUTE.**—A circular has been issued by Mr. F. W. Monk, managing director, announcing that a Conference of representatives from various Institutes in

Kent will be held at Faversham, on Thursday, July 17th, at twelve o'clock at noon. The advantages to be derived from the formation of a County Union of Educational Societies will be considered, and, should it be thought desirable, resolutions will be adopted in order to promote the establishment of an Association of Institutes in Kent. The Church of England Young Men's Institute, at Canterbury—the Chatham Mechanics' Institute—the Sheerness Literary Institute—the Deal Mutual Improvement Society—and the Faversham Institute, will be represented at the Conference; and it is hoped that many other Societies will send delegates. Should the Conference not consider the establishment of a County Association desirable, the representatives will be asked to express their opinions on such subjects as may be interesting to the Managers of Institutes.

**NOTTINGHAM MECHANICS' INSTITUTION.**—The twenty-sixth annual report speaks of steady progress. Fresh ground has been broken in the organization of classes, and in assistance given to the establishment of penny readings. The number of works issued from the library in 1862 and 1863 respectively, were 25,424 and 36,575, the number of volumes in the library being 6,642. The increase extends to every class, but is the largest in history, biography, travels, and the sciences, and very small in that in which the largest issue generally takes place, namely, novels and romances. 214 volumes have been purchased, and 23 presented, during this year. The following lectures have been delivered:—"The Authors of the Age: a Series of Written Portraits from Personal Acquaintance"—Mr. S. C. Hall; "English Notions of American Character," and "Humorous Characteristics"—Mr. G. Grossmith; "On the Art of Public Reading," and "Extempore Speaking"—Rev. A. J. D. D'Orsey, B.D., Cambridge; "On some Great Schoolmasters"—Mr. George Dawson, M.A. The classes go on satisfactorily. In the French class the quarterly payments have been 110, with an average attendance of 28 students. A class has been formed for the study of German, some twelve members having signified their intention of joining it. Dr. Wilson has resumed his studies as teacher of the Inorganic Chemistry class. The opening lecture was again delivered by Mr. J. C. Buckmaster. The number of students is not so large as at the first organization of the class. Arrangements were made by the committee for the formation of a class in Theoretical Mechanics. The members of the Discussion class number 34. Among other subjects introduced have been the following:—Literature of the Past Century—Literature of the Elizabethan Age—Items of the Obsolete—Cromwell—Forms of Government—Poems of "Rusticus"—Thomas Chatterton—Nottinghamshire Worthies—Notes on Practical Photography—Prose Composition—American War—and Capital Punishments. The chess class has 63 members. The receipts from the museum have been £58 13s. 9d., including a balance of £14 6s. 0d., and the expenditure £30 13s. 6d., leaving a sum in hand of £28 0s. 3d. The visitors numbered 4,322, the payments for admission amounting to £18 0s. 2d. The members of the society are anxious that a commodious building should be erected for the purpose of a museum, to which the inhabitants of the town might have free admission. Lectures have been delivered on British Botany, the Physiology of the Skin, and Mental Phenomena, to which the members of the Mechanics' Institution were admitted without charge. The number of members is the same as last year within two. There is an increase of nine ordinary members, and a decrease of seven honorary and four life members, the latter, of course, by death. 173 persons have joined during the year, and 23 have transferred their shares. The operative classes are much more strongly represented than formerly. The total number is 1,139, of which 329 are clerks, shopmen, and warehousemen, 70 youths under 24 years of age, and 65 females. The balance-sheet shows that the receipts have been £782 15s. 4d., and that there is a balance in hand of £101 9s. 8d.

SWINDON (NEW) MECHANICS' INSTITUTION.—The twentieth annual report shows a slight decrease in the number of members, being 1,027 against 1,032 of the previous year. The library now contains 3,358 volumes, comprising many valuable works upon science, history, geography, biography, &c. 10,358 books have been issued during the past year. The chess and draughts' room continues to be well attended. The dancing class is under the supervision of the Council, who state that it is ably conducted, and affords to the numerous members, by whom it is supported, a most agreeable recreation. The baths continue to be well attended, and conduce much to the health and comfort of the members. Amongst the lectures and other entertainments that have taken place during the year, may be mentioned a lecture by Wm. Clement, Esq., on "Little Dombey," and "Trial from Pickwick;" a concert by the New Swindon Choral Society; a lecture by C. Charles, Esq., on "Comic Characterization;" a Welsh and English Concert; and a lecture by T. Alfred Burr, Esq., on the "Electric Telegraph by Land and Sea." The lectures have not been very numerous attended. The members of the amateur dramatic club have greatly exerted themselves during the past season, and have given several select representations, which have afforded much pleasure and amusement. The choral class in connection with the Institution has given several excellent and successful concerts during the past season. The council express their gratitude to the employés of the Great Western Railway Company, who, during the past year, presented the Institution with a bust of its president, Daniel Gooch, Esq. The treasurer's account shows that the receipts have been £569 12s. 9d., and that there is a balance carried to the succeeding year of £130 9s. 7½d.

#### PROPOSED ART RESULT SOCIETY.

By C. BRUCE ALLEN, Esq., Architect.

It is always to be more or less anticipated that all fresh ideas, or new modes of working old ideas, shall at first be somewhat misunderstood; it is so with this proposed "Result" Society, and its contemplated mode of action and hoped-for influence on the Fine Arts of the present time. It may therefore be useful to explain somewhat more in detail its contemplated and precise mode of action, and how far it would differ from the Art Educational societies, now existing, in its mode of working.

It is only within these very few years that the public attention has been called to the value and importance of the workman's share in the production of all objects of Fine Art, as, indeed, in all productive art. In ordinary productive work, such as machine making and the like, it has never been doubted that the workmanship—the executive workman's share in the object—is all important, and that, in the absence of executive skill, the inventor, designer, and draughtsman are almost if not wholly powerless. This has been always of necessity admitted, but in the modern mode of Fine-Art production this important element in all work has not been recognised, or perhaps hardly even thought of, as it has been the universal idea, till within these few years, *i.e.* since the period of the 1851 Exhibition, that the great need of the time in Fine-Art work is "design," as it is called. Indeed, but lately, in the summing-up of a series of lectures on Art-work Applied to Industry, the better education of the designer is the first thing urged as the way to higher and more artistic work. There can be no doubt that "design" comes first in order, for it is the means without which the ultimate end—the resultant work—is impossible; but by itself it is in reality powerless, and always supposes the executant power ready and able to realise it and embody it in material. This is at present impossible, for the means do not exist able to render in material the artist's design, which is always on a flat surface. Does it not seem therefore a waste of means and

power to dwell thus on the importance of design, and to hold out all encouragement and help to it, without, in the first-place, doing something to provide that other absolute necessity in Art-work—the executive skill—and thus to render complete and sufficient the process necessary, *i.e.*—the working power as well as the drawing or indicative force? Would it not seem almost like beginning at the wrong end? There would, indeed, seem to be but little if any doubt, that it is much the easier problem of the two for a thoroughly able executive workman to learn to design, than it is for an equally able designer to acquire the power of actual executive skill, that is, to pass from paper to material. This proposition may, however, be doubted by some, but such may be reminded that nearly all that is left us of the art of by-gone ages is in material of some kind or other, and that there is no evidence whatever to show that drawings of art objects were in the first place made as they now are, and that the art object itself was then executed from such drawings. Our modern process seems to have been reversed—the object was designed as well as executed in material, and if anywhere represented, as in wall paintings or in manuscripts, it is a copy of the art object itself, and not a design for it.

Thus it will be seen, the more attentively the subject is examined, that the one great and chief need of the present day in Art production is a return to the old method of working in material, and that perhaps the grand cause—after all the vigorous exertions made—of modern Fine Art failures has been and is the neglect of the workman. He it is who finally gives to the public the art of the time, and through him the designer and the draughtsman must work and evidence their capacity.

But all important as is the office of the workman in art, a yet more immediately pressing need at this moment is the practical recognition and encouragement, side by side with the workman, of the art draughtsman, *viz.*, he who provides the executive workman with the necessary guide for his work, and without which he is at the present day almost helpless; and it is to this part of the subject the attention of the Society is asked.

It seems a somewhat singular thing that no effort has yet been made—in these days of inquiries and statistics—that no search has been instituted for the purpose of finding out who they are who produce all the multitude of designs and patterns which fill our shop windows, and where the designs and patterns come from. Let anyone pause for a few minutes before a window full of "woven fabrics," as they are learnedly termed, and notice the "designs." The most industrious book-hunter will in vain search for any evidence of "precedent" in the window show; all his book experience will fail to guide him to an origin of the odd and meaningless shapes he will see. It will be equally useless in the great majority of cases to go to natural forms and recollections for a solution of the problem, and he will be equally unable to conclude that they are each of them the product of pure individual inventiveness on the part of the designer and draughtsman—sheer original brain products. The longer he looks the more he wonders, and he moves on at last in sheer despair. They clearly come neither from precedent—old art—nature, nor the head of the draughtsman. If he should have confined himself to cheap shop-windows, a further search in dear shop-windows will not make a whit clearer the puzzling difficulty. In the largest and most expensive Bond-street shop window at this hour may be seen a pattern, on the very richest silk, produced, as it would seem, by dropping colour of the richest kind on the silk surface, and then before it has had time but to half dry, smudging the spots rapidly right and left with two fingers. The whole surface is covered with this design, and the unhappy purchaser, with all her money, is compelled to admire it and take it, or if not, the one next to it, which is perhaps even more fanciful; a few short sticks and twigs dipped in colour and thrown into a small heap, and stamped on the gauze surface, produce

the "new design." These are not cheap goods, nor made for a foreign market, but are solely for those who can pay and are ever on the look-out for the costliest and newest. Are not the men or women who do this worth a line of print in a statistical inquiry into our art manufactures?

It must be here borne in mind—it being the object of this notice to ask attention to it—that these and other patterns and designs are not the production of the workmen who weave or paint the fabrics, but are the works of the draughtsmen and designers in the factories; it is they who originally draw the pattern on paper for the wood or metal blocks, or card, a thing never yet seen in any public exhibition of art manufactures. These foolish performances would, if publicly exhibited, guide the public mind to a knowledge, and a valuable practical knowledge, of the lowest source of modern art designing, and to the condition of those who supply it. Not exhibitions, it must be understood, like those the Society have hitherto been in the habit of holding and seeing; but it must be, in this case of fabrics, of specimens of the three objects—the two *means* and the final *result*, *i.e.*, the original design or drawing on paper, the wood or metal block, which is, of course, by a workman, and a specimen of the silk or stuff itself. Thus would it be seen that in the art in the simplest and commonest stuff, there are never less than three executants—there are indeed more commonly four, for, in addition to the draughtsman on paper, there is another, a copyist, for the wood block. These things are really and truly named manufactures, and it will be seen that by the time the original art thought, whether good or bad, is ready for the public, the art in its originality is very thoroughly and effectually worked out of it. This lowest art is here noticed, not because it is the worst, but because it is in reality the newest and most inventive. John Bull is on his own resources—nineteenth-century resources. There are other things and patterns equally silly, such as the whole width of the silk covered with "fret" from the Parthenon, the musical stave and bars, an entire sheet of penny postage stamps! and so on. No designer or draughtsman would venture to exhibit such things as these on paper as specimens of his powers; and the hope is that when he and his productions are asked for as part of future art result exhibitions, that one step higher in originality and sense may be reached. And not only will the whole process of each manufacture be thus made evident, and a road perhaps found out of the present evil—that of being able to get nothing—but the why so much valuable artistic power is lost, will, in no length of time, become visible; for when the original idea, even when a good one, is seen to pass through so many various heads and hands, all differing from each other, it will be found that this is simply to lose and waste such art power, the original thought growing weaker and weaker as it is successively copied and re-copied by successively inferior artists. It will be very soon seen, too, that to manufacture original art is impossible, and that the only legitimate and certain way of getting, in an art work, the impression of the power and capacity and meaning of the artist, is that the artist should either himself execute the work, so that it shall be his and his only, or, which is the next and the second best way—for the artist to work side by side with the workman and to provide him directly with the guiding means or working drawing. It is for this end the Society may, it is thought, afford such kindly and valuable help, by the recognition of the artist draughtsmen now doing this work in our art shops and factories; and by abandoning the present idea of encouraging the copying of objects of antique art by artists who have passed away.

The Society happily has now taken up, as a regular part of its art work, the recognition and encouragement of the *bona fide* workman—this year especially, with so munificent a sum—the income, indeed, of two or three ordinary societies; it is now, therefore, respectfully urged to include in future years the artist-draughtsmen, who always in the art manufactures supply the workmen with

the indicative means and working drawings so absolutely required by the actual workmen, and thus to complete its work. The great caution required is that of avoiding show drawings, or sketches, or water-colours, and to accept only the rough "working drawing" as it is termed, such working drawing to be the one really worked from by the art-workman in the manufacture of the object exhibited. In a short time this would evidence the great but hitherto unnoticed fact that the art of drawing in the past was that of the power to draw on material, and that all our present vast apparatus for teaching drawing, and efforts through it to get at an art result, is simply a modern mistake. The schools of design have now been in active existence for nearly a quarter of a century, but have not yet touched the shop windows, and for the simple reason that the whole scheme of art teaching aims at picture-making as an end, and teaches drawing as an end, and not simply as a means.

#### WATER SUPPLY OF NAPLES.

Signor Felice Abate, an Italian civil engineer, who obtained, in 1847 and 1855, two medals from this Society for inventions connected with his profession, has lately put forward a plan for supplying the city of Naples with water. Mr. John F. Bateman, F.R.S., engineer to the Manchester, Glasgow, and many other waterworks, having been invited to give his opinion upon the plan, has made the following report:—

"I have carefully considered your project for the restoration of the ancient Roman aqueduct of Claudius, and for supplying, by its means, the beautiful spring waters of Serino to the inhabitants of the City of Naples. With the full information which your plans and sections, and your written documents and personal explanations have afforded me, I have been enabled to make independent estimates of the probable cost of the undertaking. Pressing engagements prevent my writing at present as full a report on the subject as I could wish, but as my calculations are complete, I hasten to give you the general result, with such observations on the scheme as will put you in possession of my views and opinion, and enable you to bring the matter before your friends in this country. I shall be able, very shortly, to enter into fuller details.

"The City of Naples contains a population of between 400,000 and 500,000 persons. The present supply of water is, as I am informed, very small and quite insufficient, and many disadvantages, ill health, and mortality are the result; it is only 3,000,000 or 4,000,000 gallons per day, and is delivered at too low a level to supply the higher parts of the town. In so hot a climate as that of Italy a full and abundant supply should be estimated at the rate of 80 gallons per head per day, and ought on no account to be less than 20 gallons per head. The highest of these estimates would give a gross quantity of 15,000,000 gallons per day, and the smaller 10,000,000 gallons.

"Allowing for the present supply and supposing that to be still available for general purposes, preparation should be made in any new work of considerable extent for bringing at least 12,000,000 gallons of water per day, although a smaller quantity might possibly, in the first instance, be sufficient.

"The springs of Serino have been measured, and are estimated to yield, in the driest periods of the year, 11,000,000 gallons per day, and an average of about double that quantity, or 22,000,000 gallons. In years of extraordinary drought, they fall below these quantities; but, from a consideration of the physical features of the district, and its geological formation, it is anticipated that much spring water which now issues at lower points may be intercepted, and the quantity available for Naples materially and permanently increased. By the construction, however, of store reservoirs to impound the surplus water of wet seasons, the larger quantity named above could certainly be obtained, but as 11,000,000 would,

in addition to the present supply, appear to be sufficient for some time, and may, as I understand, be safely relied upon, I will confine my estimate to the cost of obtaining this quantity, with preparation for increased supply when it may be required.

"The springs issue from limestone rocks at an elevation of about 1,200 English feet above the level of the sea, and at a distance of about 47 miles from Naples. They were originally conveyed to the city by the Claudian Aqueduct, about two feet seven inches wide and six feet high, with a varying inclination, finally entering the city at the Ponti Rossi, 136 feet above the level of the sea, at much too low a level for the supply of the higher parts of the city.

"You estimate, after careful examination of the whole aqueduct, that, with the exception of about thirteen miles, the whole is in sufficiently good repair, when properly cleaned out, to be again employed with perfect success for conveying the water to Naples, and you propose to overcome the defect of low elevation at the termination of the existing aqueduct by laying down, for the supply of the higher parts of the city, a line of pipes of sufficient diameter, which shall commence at a point near Petruo, high enough for the purpose. This point will be about thirty miles from Naples, at an elevation of about 660 feet above the sea, and the pipes will terminate at a point above the city near Antignano, about 490 feet above the sea.

"The first eight miles of the aqueduct will require reconstructing, and this length may be shortened to four miles, by which additional pressure can be brought into the tunnel through the mountain of Forino, which is nearly four miles in length. By this means the aqueduct would be equal to the passage of about twenty-five million gallons per day. From the lower end of this noble ancient tunnel there is a magnificent descent of 500 feet down the face of the mountain, from the foot of which the piping to the city would commence. From this point the water would be divided, the ancient aqueduct conveying about two-thirds, and the pipes the remainder. At the end of each a service reservoir would be constructed, each capable of containing about one week's supply, to provide against casualties and interruptions, and from these reservoirs the water would be distributed to the city. The whole of the water would be supplied by gravitation, without any cost for pumping, and all the necessary works are very simple and easy of construction. I estimate the total cost, including the restoration of the ancient aqueduct, new aqueduct where required, the main pipe of 24 inches diameter from Petruo (equal to a delivery of 4,000,000 gallons per day), the two service reservoirs, and complete distribution, the whole on the scale of 15,000,000 gallons per day, with 15 per cent. for contingencies, at about £620,000. To this sum must be added the cost of engineering, administration, interest during the construction of work, and other expenses. The whole work ought to be thoroughly well done, every expense included, for a sum not exceeding £750,000. This is a small cost for so large a population; it is 30s. per head for an abundant supply of water by gravitation, only one-half of the cost of the supply to Glasgow or Manchester.

"Taking the dry weather volume of the springs, the hydraulic power which would exist in the rapid descents of the aqueduct, the greater part of which could be utilised, would be about 1,200 horse power constantly. Probably a large portion of this would be converted to useful manufacturing purposes, as a railway now passes nearly alongside the aqueduct to the foot of the great fall below the tunnel of Forino. Here would be a source of income which would do much to reduce the cost to the city.

"On the whole I beg to congratulate you on the promising result of your project, and to express a hope than an undertaking of such immense importance to the prosperity and welfare of Naples may be successfully carried out. I am satisfied that it cannot fail at the same time to be highly remunerative to those who undertake it."

## Fine Arts.

ROYAL SCOTTISH ACADEMY.—At a meeting of the Council of the Academy on Monday, the 4th instant, George Harvey, Esq., the eminent landscape and historical painter, was chosen President of the Academy, in the place of Sir John Watson Gordon.

EXCAVATIONS AT POMPEII.—The steady perseverance of the present government brings new treasures to light almost daily. Last week only a fine bronze statuette of "Silenus" was disinterred from beneath the ruins of a wall. The style of this work is described as bearing a strong resemblance to that of the famous "Dancing Fawn," also discovered at Pompeii. Two large elegant and massive silver candelabra were also found in the same house with the "Silenus." Another very interesting discovery was made on the 24th of last month, when the lower part of a house, including a cellar, well, bath, and family altar, was laid open to view. Amongst the ashes on the altar was found a half-burnt pine cone, which was probably lighted before the "Penates" of the unhappy inhabitants at the moment of the grand catastrophe.

PHOTOSCULPTURE.—In the *Journal* a short time since, a notice was given of a new application of photography called "Photosculpture."\* The process has been carried out with great success in Paris, and specimens executed there were exhibited by Mons. Claudet at the Royal Society's *soirées* this year, and attracted much admiration for their life-like and artistic character, as well as for the ingenuity displayed in this new application of photography to the purposes of sculpture. It is now proposed to carry out the invention in this country, and a company has been formed for this purpose, with Sir David Brewster as its chairman, and under the management of Mons. Claudet.

## Manufactures.

RADIAL RAILWAY LOCOMOTIVE.—In the Library of the Society may be seen a model, to a scale of one-fourth the full size, of a locomotive engine frame, built by Mr. James Cross, engineer of the St. Helen's Railway, on the plans of Mr. W. Bridges Adams, upwards of twenty years a member of the Society. This is a tank engine, with a separate tender, and the longest ever built, being on eight wheels, with the extreme base twenty-two feet in length; consequently, the engine, by the mere fact of length without increased height, would, even if constructed in the usual rigid manner, increase in steadiness in proportion to its length. Such an engine, if constructed in the usual manner, would possess so much friction against the rails as to be nearly useless. But this improved engine is so constructed as to work freely on a double or reversed curve of 98 feet radius, equal to one chain and a half, as may be seen and tried with the model, the wheels of which roll and do not slide. On the curved line of rails, when the wheel flanges touch the rails, they yield laterally, by the axle boxes sliding in curved lines through the horn plates, so that the axles length-long are placed in lines radial to the curves of the railway, being always at right angles with the rails; the result is that the flange friction is prevented, and the risk of getting off the line by the flanges mounting the rails is removed. An engine altered to this plan is now working successfully on the North London Railway. It is not generally known that previous to the reign of Queen Elizabeth there were no four-wheeled carriages in England made to turn in a circle, *i.e.*, the axles were made rigidly parallel, and could not roll in curved lines, but only slide by great force. This structure, being that of the old Roman cars on four wheels, was one probable reason why the Romans made their roads in straight lines. And this

\* Vide vol. xii., p. 71.

structure is precisely that of modern railway carriages, in which the movement is partly rolling and partly sliding, even on what are called straight lines, which are not straight as regards the rail surface, but a series of minute curves, while on curved lines the movement is nearly all sliding. In the improved engine the principle conforms to the common road practice, by permitting the axles to diverge from their parallelism, with the difference that the wheels on the common road are steered by the pole, or shafts, while on the railway the rails themselves perform the steering. And thus lines of railway may be made with any desirable amount of curvature down to one chain and a half radius. Not that it is desirable to use lines of great curvature in preference to straight ones, when the cost is equal and other circumstances do not interfere, but it is very important to be able to avoid costly outlay by occasional sharp curves, and especially at termini, and to avoid wear and risk at points and crossings. And it is also desirable to form stations close to towns or in the interior, and in such circumstances this plan of radial axles furnishes the facility of turning round the corners of wide streets if necessary. And, moreover, as the length of the machine ceases to be an injury and becomes an advantage, the engine can run either end foremost with equal facility and safety; and as experiments have proved that the engines with radial wheels run with the greatest steadiness on straight lines, and by the diminution of friction develop the greatest amount of duty, it is probable that this will be found the best construction both for express trains and for heavy loads. The same principle applied to trains diminishes their resistance, and samples of carriage construction may be seen in the library, as well as specimens of elastic permanent way, a system tried for a considerable period on the North London Railway, demonstrating a fact little understood, but very important to shareholders, that the destruction of rails arises less from the friction of the iron than from blows or concussion, which disintegrates the scrap iron of which they are composed. It is found practically that where the blows are eluded by the elastic principle no disintegration takes place, and that iron rails under such circumstances may be more durable than steel applied in the usual rigid mode. A paper treating of the whole subject will probably be read by the author of the system during the next session.

### Commerce.

**AMERICAN COTTON.**—The *Boston Advertiser* gives a table showing the receipts in England, in 1862 and 1863, of cotton which can properly be assumed to be American. It appears that while the direct receipts from Southern ports have fallen off largely, those from the Bahamas and Bermudas have enormously increased, thus showing the route which the Confederate trade follows. The islands which figure in the British returns are the ports of transshipment. Large steamers are loaded in England for these islands and there exchange cargoes with the small blockade-runners. Information from England shows that one-half of each cargo is for the account of the Confederate Government, and one-half to the owners; the latter not being allowed, however, to ship any supplies not absolutely needed in carrying on the war. So far as the sales of prize cotton show, it does not appear that the blockade-runners are intercepted in more than one trip out of six. From reliable computations it appears that in 1863 130,000 bales of cotton were available in England for the Confederate Government or its supporters, for the purchase of supplies or munitions of war. This cotton was sold for gold at a rate not less than 200 dollars per bale, producing at least 26,000,000 dollars. The Confederate Government, with its share, doubtless paid the interest upon its bonds, and recruited its credit so far as to make the 26,000,000 dollars equal to double

its amount in purchasing arms and supplies. Used in this effective manner, the cotton was sufficient to arm, clothe, and set in the field an army of 400,000 men.

**HORSE-FED POULTRY.**—Poultry is a very important item of consumption in France, and consequently any method of producing delicate chickens, juicy poulets, and fat capons at a moderate price, offers an attractive subject of consideration in more respects than one. It has been observed that poultry does not thrive best on a pure grain diet, but that, on the contrary, a mixture of animal matter has great advantages. Acting upon this hint, or rather starting from it, and proceeding to the extremity of the animal-food theory, a person commenced some years since at Belleville, an outskirt of Paris, the production of poultry out of horse-flesh. There are at present several of these hippophagous farms, which supply a considerable portion of the fowls consumed in the capital of France, but the mode of feeding is kept as secret as possible. It appears, however, that the system answers well, provided the creatures are not kept too long on an exclusively animal diet, in which case they become diseased and totally blind. Some time since an enterprising individual introduced great improvements into this system of raising poultry, and the results have been highly satisfactory. This new establishment occupies nearly thirty acres of land, and is capable of accommodating about a hundred thousand poulets at a time. The poulets are divided into parties, according to their age, and each party has its yard and dormitory, both of which are kept with the utmost possible regard for the health and comfort of the boarders. The food consists almost entirely of horse-flesh, supplied from a slaughter-house adjoining the farm, and belonging to the same proprietor. The blood of the animals is carefully saved, and fetches a good price; the hides go to the tanners; the head and hoofs to the Prussian blue makers; the marrow to the perfumers; the large bones to the button makers; and the refuse is converted into manure. The approximate value of the carcase of a horse in France has recently been stated to be as follows:—Skin, weighing from 50 to 75 lbs., 13 to 18 francs; long hair, from 3d. to 3d. per lb., one to three-pence; flesh, from 35 to 45 francs; blood, about 2.50 to 3.50; intestines, 1.60 to 1.80; tendons, 1.20; grease, value from 4 to 30 francs; hoofs and bones, about 2.50; and shoes and nails about 25 to 50 centimes; total, from 60 to 120 francs—£2 8s. to £4 16s. The number of horses slaughtered averages about twenty a day, and the affair is so well organised that the sales pay all expenses, leaving the flesh as clear profit. This last product is boiled in enormous coppers, chopped up as if for sausages, and conveyed to the farm after being seasoned with a small quantity of salt and pepper, which prevents putrefaction and also contributes to the health of the poultry. It is found that the production of eggs is more profitable than the sale of chickens, as under a meat diet the hens lay all the year round, and never exhibit an inclination to set. During last winter this establishment sent 40,000 dozens of eggs per week to market, at about sixpence per dozen. The hens yield as an average about twelve shillings per head per annum, and they lay for four years, at the end of which time they are fattened for three weeks with bruised grain, and sent to market alive. The steam hatching apparatus of the establishment is on a grand scale, furnishing employment for fifty or sixty women. The spare cocks are sent to market, and these amounted last autumn to more than a thousand dozens in three months. The manure is one of the important products of the establishments; it amounts to about 360 cubic metres a year, and is said to be one of the best fertilizers known, and to be equally adapted to all kinds of crops.

### Colonies.

**COTTON CULTIVATION IN QUEENSLAND.**—From the accounts of the severe floods during the month of March,

serious anticipations were formed as to the safety of the cotton crops in this colony, most of the plantations being situated on the alluvial banks of the principal rivers and creeks. As, however, a great variety of land is being operated on by cotton growers, and considerable diversity of opinion has long existed as to what was a suitable character of land for cotton growing, some anxiety has naturally been felt for the reports of the floods and continued wet weather. However, on the whole, cotton has suffered less than most crops, and cotton farms in well-selected localities are quite safe. On several of the plantations cotton-picking has commenced, and although later than usual an average crop is expected. With regard to the quality of the Queensland cotton, it will be superior to any yet exported, great care having been taken in the plantations of best seed; and past experiences have proved that, in the preparation of the fibre for market, where the greatest care is adopted in picking and ginning, that the more remunerative prices have been obtained. Samples of sea island cotton are well got up for the home market, and of superior quality. It is very difficult to estimate the probable export of the season's cotton, though there is good reason to believe that, had storms and floods not occurred, a large quantity would have been exported in April last to the home market.

**CANADIAN FISHERIES.**—A private letter, dated May 28, says that there is little improvement in the seal fishery. The north-east wind continues, and the coast is still blocked with ice. Some 30 or 40 sealers have arrived in all, bringing about 5,000 seals. The bulk of the fleet are still ice-bound at the northward, and their return is not expected until a change of wind occurs. Business has been generally interfered with by the ice blockade. The same cause which prevented the arrival of foreign vessels prevented the outport fishermen getting into St. John's for supplies, preparatory to proceeding on codfishing voyages. The protracted absence of the Newfoundland sailing fleet, comprising several hundred vessels, manned by many thousand men, has become a source of painful anxiety. Under ordinary circumstances the supplies furnished the sailing vessels should scarcely have lasted their numerous crews half the lengthened period that has elapsed since their departure for the ice fields.

### Publications Issued.

**MEMOIRS OF THE DISTINGUISHED MEN OF SCIENCE OF GREAT BRITAIN, LIVING A.D. 1807-8.** By W. Walker, jun., with an Introduction by Robert Hunt, F.R.S. Second edition, revised and enlarged. (*Spon.*) The first edition of this work was intended as a hand-book to a remarkable engraving, by Mr. W. Walker, from a design by John Gilbert, of an assemblage of fifty-one eminent men (astronomers, chemists, men of science, engineers, &c.), grouped in the library of the Royal Institution. The memoirs proved so attractive that the publishers, having made several additions to the list of worthies, have reprinted the volume, with an introduction by Robert Hunt, F.R.S., and it now contains the lives of Watt, Rennie, Telford, Mylne, Jessop, Chapman, Murdoch—the first to introduce gas into practical use; Rumford, Huddart, Boulton, Brunel, Watson, Bentham, Maudslay, Dalton, Cavendish, Sir Humphry Davy, Wollaston, Hatchett, Henry, Allen, Howard, Smith—the father of English geology; Crompton—inventor of the spinning mule; Cartwright, Tennant, Ronalds—the first to successfully pass an electric telegraph message through a long distance; Charles Earl Stanhope, Trevithick, Nasmyth, Miller, of Dalswinton, and Symington—the inventor and constructors of the first practical steam-boat; Professor Thompson, of Glasgow, Troughton, Donkin, Congreve, Herschel, Maskelyne, Baily, Frodsham, Leslie, Playfair, Rutherford, Dollond, Brown—the botanist; Gilbert and Banks, the Presidents of the Royal Society

at that epoch of time; Captain Kater, celebrated for his pendulum experiments; Dr. Thomas Young, and Jenner—the benefactor of mankind; James Ivory, Dr. Priestly, and Cort—the father of the iron trade.

### Notes.

**GIFT TO THE SOUTH KENSINGTON MUSEUM.**—An interesting collection of objects has lately been presented to the South Kensington Museum by the Rev. R. Brooke, of Gateforth Hall, Selby, consisting of numerous objects of the 16th, 17th, and 18th centuries, used and preserved in the families of Brooke and Osbaldistone, which will enrich several of the divisions of the Museum. Amongst the objects thus acquired by the nation are a unique collection of posy rings with sentimental mottoes of the 16th, 17th, and 18th centuries, gold and silver watches, very fine pillow and guipure lace, a series of walking canes, military accoutrements of various kinds, costumes and court dresses (male and female) of the 18th century, a collection of spurs for cock fighting, hoods for hawks, &c., which illustrate bye-gone sports, besides a miscellaneous but interesting and suggestive collection of "knick-knacks," which our great grandfathers and great grandmothers used in their domestic life. Some of these objects, the posy rings and watches, for example, are already exhibited, and others will be gradually shown as they are arranged.

**FRENCH ACADEMY OF SCIENCES.**—A paper was recently read, at the Academy of Moral and Political Science, from Mr. E. Chadwick, C.B., the newly-elected Foreign Associate, on the English law respecting the employment and education of factory children, which attracted considerable attention. The subject is one which has been well discussed in England, but it is almost new to France, and promises to give rise to important considerations. The subject of primary education has received great attention in France, and it must be admitted that the capital deserves great praise for the manner in which it has provided for the instruction of its poorer children; but in the factory districts much remains to be done, and Mr. Chadwick's communication seems not unlikely to furnish the necessary impulse.

**A PICTURE GOT OUT OF THE FIRE.**—A curious incident occurred the other day with respect to a marine picture, "A View of the Golden Horn and Constantinople," by Gudin. The Comte Aguado purchased it some time since of the artist for 25,000 or 30,000 francs, and the other day, when a fire happened in the connoisseur's apartments, this picture was supposed to have been utterly ruined, and the insurance company, having indemnified the Count, sent it to the auction-room to be sold for whatever it would fetch. Its appearance as an object of vertu created considerable amusement; it was thoroughly blackened, and bore the marks of two foot prints made by the heavy shoes of a fireman, and when Mr. Bruaut, a picture dealer, became the purchaser for the sum of 325 francs, his friends and others said with a smile that they should be glad to hear of his having made a thousand francs by his bargain. M. Bruaut took the matter very calmly, thinking perhaps within himself that those who laughed last laughed best, and taking home the picture, he set to work to clean and repair it; and this he has accomplished so well that critical judges declare it to be as good as ever; and it is whispered that Count Aguado is so satisfied with M. Bruaut's work, that the "Golden Horn" is likely to be re-elevated in the gallery from which it was rudely expelled in consideration of a sum of money very little less than that given for it originally. The resuscitation of the work is a fortunate thing for M. Gudin, the artist who has changed his style materially, and certainly has not for many years produced a picture of equal value in general estimation. The fireman's footmark will be always an interesting kind of monogram.

## Correspondence.

## THE ROYAL ACADEMY.

SIR,—Now that the Commissioners' Report upon the Royal Academy, and their own "Observations" in reply, are in print before the public, and the matter contained therein has formed subject for debate in both houses of the legislature, it is well that those interested in the Arts generally should know something of the wants, demands, and concessions of its professors and the public; and in no journal would a few remarks be more *apropos* than in that of the Society of Arts—a venerable Society—that can claim the paternity of many. The first Exhibition of Paintings, which led to the formation of the Royal Academy, was held in its Rooms, where the most distinguished members of the Royal Academy in youth have been rewarded—and where its veteran professors—Etty, Mulready, and others—have seen their works collected—where art objects have been discussed, and laws for their protection argued and consolidated. With regard to the documents—"The Report of the Commissioners" and "The Observations of Royal Academy" in reply, the artists, having the two before them, would, it is thought, be informed on all points that so deeply concern their welfare and the interests of Art; yet this is not the case, but the artists having—at least the mass outside the academy—taken much trouble to master the details of the two documents; it is now desirable that their views should be declared, and that the subject should be ventilated. This is the more necessary in order that practical and business ideas may be united with theory in the foundation and consolidation of a National Academy, that should teach, develop, and honour the Art power of the country, and encourage it to shed its enlightening influence upon everything, as it did in the middle ages, when an artist was not alone a painter (working for an annual show), but a sculptor, architect, and engineer, and often a scholar, poet, and musician. As a body, the artists are grateful for the efforts of the Royal Academy Commission—though, perhaps, they may be pardoned for viewing the matter more as a personal affair, that will do them greater individual good than develop the art they ought to love for its own sake. Hence, perhaps, the greatest charm for the mass of artists is the proposed extended space for the exhibition of their intellectual wares. Instead of 1,062 works, as at present, it is hoped room will be found for the exhibition of many thousands—including large experimental works, worthy of a great educational establishment, that seeks not alone to please the eye, but to instruct the public to appreciate art and processes of art applied to things in general; in continental exhibitions we find a very wide range taken, and all classes of works fairly displayed, until art approaches the confines of science—some few thinking it would be well to display all works sent, as at the Paris *Salon* this year. There were shown 3,459 works, 379 gracing a separate chamber, called "the Purgatory," being of (presumed) inferior quality. Sculpture and architecture should be fairly displayed even to the practical. The sculpture, if shown in connexion with painting, would require the most judicious arrangements. The associate class is the next great subject that interests the mass of artists at present unconnected with the academy, a limited number having great charms for a few who aspire to a seat and influence in its councils. Now there is no objection to this, provided there can be a large associate class from which to draw the fifty representative associates to sit in council with the fifty academicians. It would be a lamentable thing to think that there should be but one hundred artists in the United Kingdom worthy to be members of a national academy and bear weight in its balance. This the Academy has itself felt whilst proposing that the associate class should be unlimited—a very wise and judicious proposal if they grant some of them a *bonâ fide* influence in the councils that

are to guide the institution. The wide base advocated I have heard objected to, as throwing greater power into the Academy, a thing to some extent true, though not to be dreaded, if the scales are equally adjusted. The fact is, the great world of art and artists ought to be connected with it, though they may never exhibit upon its walls or even elsewhere. The greatest freedom should exist upon this point, and the Academy be glad of the company of all men of talent who can aid the common weal by their theory or their practice. A great mural painter, who does not produce easel pictures, or a sculptor always engaged on great public works, may not care for exhibitions, and it would be unjust to compel him to do so; the wall painters may find space enough in public halls, and the sculptors in the streets. Regarding the "lay element," the artists, with a very few exceptions, have a great dislike to it, though hardly with reason, for they fail to show why a few distinguished noblemen and gentlemen united with them in a common cause, would augur ill, though the presence of laymen in practical matters of art would be of little use; yet, if nominated on the part of the Crown to act as trustees, men of influence and high position could play a very useful part, and add dignity to the Academy. The case of "Art-Workmen" in connection with the Academy I find pretty much as stated in a letter to the *Journal* of January 8, 1864; artists thinking that whilst the Royal Academy should do everything to foster and encourage creative art, in its widest sense, to decorate and beautify everything, yet when that creative power passes into the hands of a translator—into another tongue—it appeals to technicalities hardly within their province, being a department of art so connected with the technicalities of science, and that it cannot be in better hands than those of the Society of Arts, who, by their prizes to art-workmen, are doing infinite good. On the rival claims of locale—Trafalgar-square or Burlington-house—opinion is divided; though I think the balance is in favour of the former, particularly as a place for an annual exhibition, and central for the schools. Artists of established repute, of course, look upon the exhibition as the soul of the Academy, and the schools of minor importance; but certain it is the institution becomes rich by the one and less rich by the other. As the site for a dignified educational establishment, Burlington-house is most desirable and quiet; it is possible that the frontage may not be equal to Trafalgar-square, though the position in Piccadilly is preferable for visitors, not a tithe coming from the east. To be at the junction of Regent-street, Bond-street, and Piccadilly would certainly be a grand thing for art in the metropolis, and its patrons also. As to many minor proposals of the Royal Commission and the Royal Academy, they find much favour with the world of art, though the "Report of the Commission" is better known than "Observations of the Academy," the former having been before the public some months, whilst the latter has not long been published. It is most desirable that both documents should be collated and consolidated, the claims of artists and the public duly considered, that the Academy may enter upon a new lease as lasting as the old one at its foundation some century ago.—I am, &c., JOHN LEIGHTON.

The following memorial has been sent to Earl Stanhope, and was mentioned in the debate in the House of Lords on Friday, June 24th. I forward it to show the feeling of artists on this subject:—

We, the undersigned artists, having carefully considered that portion of the Observations of the Royal Academy which relates to the mode of election and to the position of the future associate class, are of opinion,

That the Royal Academy scheme is unsuited to the wants of the profession and incompatible with a liberal constitution.

In support of which opinion, we beg to offer the following

## REMARKS.

The Royal Academy Commissioners propose that the number of Associates of the Royal Academy be increased at once to 50, with power at any time hereafter to fix a larger number with the assent of the Crown, and "these 50, conjointly with the Academicians, should form the General Assembly."

The counter proposal of the Academicians, as expressed in their "Observations upon the Report of the Commissioners," is,

That the new class of Associates should consist of an indefinite number of professional artists. That the right of nomination for filling up vacancies, both in their own and in the upper class, shall be given them, but that they shall be unrepresented in the General Assembly. Had this right of nomination been understood by the Academy in the ordinary acceptance of the term; in other words, had the Associate class been the nominating and the Academicians the electing body, we should not (though greatly preferring the scheme of the Commissioners) have taken exception to the proposal; but the authors of the Observations explain that the mode of nominating the Associates of the new class is as follows:—

"The secretary shall at an appointed time send a printed form of nomination to each Academician and Associate, and shall invite him to insert in such printed form the names of the artists he may desire to propose as candidates for the rank of Associate, according to the number of elections previously recommended.

"The nomination paper, so filled up and signed by the member, shall be returned to the secretary within a specified time."

From this it appears that the Academicians nominate as well as the Associates, and as each member has to sign his nomination paper, those sent in by the Associates may be utterly disregarded, and thus the so-called right of nomination reduced to a mere power of expressing an opinion.

That this is a correct view of the question appears from the following paragraph:—

"The right of nomination, which we propose to distinguish from personal voting in elections, is an important privilege as such, but its great utility would be to put the Academicians in possession of opinions which might sometimes differ from their own."

We cannot refrain from remarking that the right of expressing an opinion differing from that of the Academicians does not, in our mind, constitute an important privilege.

We cannot agree with the authors of the Observations in thinking that, under the system recommended by the Royal Academy Commission, the Associates who might be candidates for the higher rank would be in a less independent position than the Associates are at present.

We can, at any rate, answer for ourselves, that should we ever be called upon, as Associates, to take part in the General Assembly, we shall be both ready and willing to express our independent opinion. We trust that the time has gone by when the fear of giving umbrage to the older members would embarrass the candidate for academic honours; and should any such fear still linger amongst the more timid members of the profession, we think that nothing would tend more to extinguish it than the institution of a General Assembly similar to the one recommended by the Commissioners.

We agree with the Commissioners in thinking that "three hanging committees should be annually nominated by the Council and elected by the General Assembly; and that each committee should consist of two Academicians and one Associate." We cannot conceive how this Associate would be placed in a wrong position. He would not be expected to act as an uncompromising and partial advocate of his class, but as a fair representative of the younger and rising school.

The Academicians remark very justly that "In a constituency of artists there are, or should be, no rival

interests;" and yet their whole argument is founded on the assumption that such rival interests do exist, and that the rivalry must be extinguished by keeping the Associate class down. It seems to us utterly impossible that any question could arise on which the whole of the Academicians would take one side and the whole of the Associates the other; but, supposing such a contingency possible, it might be provided against, by limiting the number of Associates who would sit in the General Assembly to those who were habitual exhibitors.

Neither the Commissioners nor the Academy offer any privilege to the Associates with respect to the placing of their works in the exhibition.

We are nevertheless of opinion that, so long as such a privilege is retained by the Academicians, it ought to be extended (though perhaps in a minor degree) to the Associates. At the same time, we freely acknowledge that, could this privilege be altogether abolished for all classes, and the exhibited works placed according to merit alone, the interests of Art would be promoted thereby, and the standard of the annual exhibition greatly raised.

[Here follow the signatures.]

## MEETINGS FOR THE ENSUING WEEK.

TUES. ...Zoological, 4.

WED. ...Literary Fund, 3.

## Patents.

From Commissioners of Patents Journal, July 1st.

## GRANTS OF PROVISIONAL PROTECTION.

Chains and chain cables—1261—G. Homfray.  
Clay, &c., machinery for treating—1417—J. A. Wade.  
Embossing in coloured relief—1462—R. Kendrick.  
Fabrics, printing—1413—W. Clark.  
Fire-arms, breech-loading—1395—W. J. Matthews.  
Jute, treatment of—563—T. Gray.  
Looms—1448—R. Hall.  
Oils, refining—1484—J. A. Pola.  
Ordnance, &c.—1431—P. M. Parsons.  
Rags, treating—1453—G. Rydill.  
*Sapota mulleri*, extracting juice of—819—S. W. Silver.  
Sewing machines, &c., self-acting motion for—1298—W. Passmore.  
Soap, manufacture of—1443—C. H. Snell.

## INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Ores and metals, smelting—1564—G. Haseltine.  
Paper bags, machine for manufacturing—1603—W. E. Gedge.

## PATENTS SEALED.

21. M. Bayliss.	109. J. E. Baker.
30. J. J. Hays.	127. E. Lord.
37. E. Fairburn.	925. F. A. Gatty.
39. R. A. Brooman.	

From Commissioners of Patents Journal, July 5th.

## PATENTS SEALED.

56. P. McLaurin.	97. M. A. Dietz.
59. W. Brookes.	106. N. Thompson.
64. J. Coppard.	116. C. Reynolds and J. Bar-
67. W. E. Gedge.	ington.
69. J. N. Garrod.	140. G. Jenner.
76. J. Coates.	168. J. H. Johnson.
86. L. E. C. Martin.	186. J. Shaw.
88. C. Askew.	187. J. Shaw.
89. W. Welch.	226. J. Zacherl.
90. C. Bartholomew.	275. F. E. Martineau.
92. P. McIntyre.	880. C. A. Ferguson, jun., and
94. G. Wilkins.	T. Ferguson.
95. G. W. Hart.	

## PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1654. H. J. Rouse.	1750. J. Farron.
1674. L. H. Spence.	1695. P. Spence.
1701. W. H. Ludford.	

## PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

1815. S. Nye.